Lecture 1
Introduction to cardiovascular diseases

By: Ahmed Rashad Mashaal, M.D.

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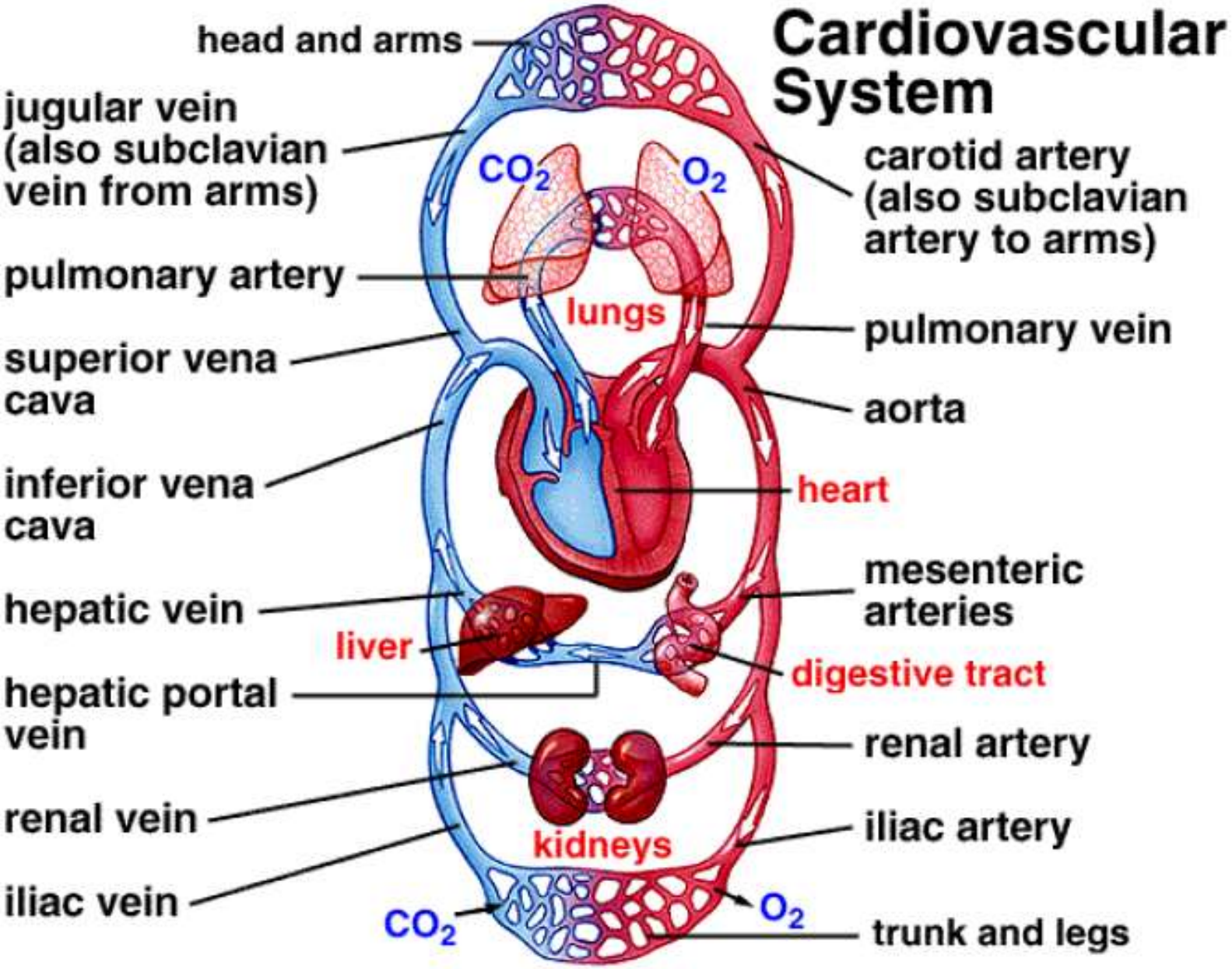
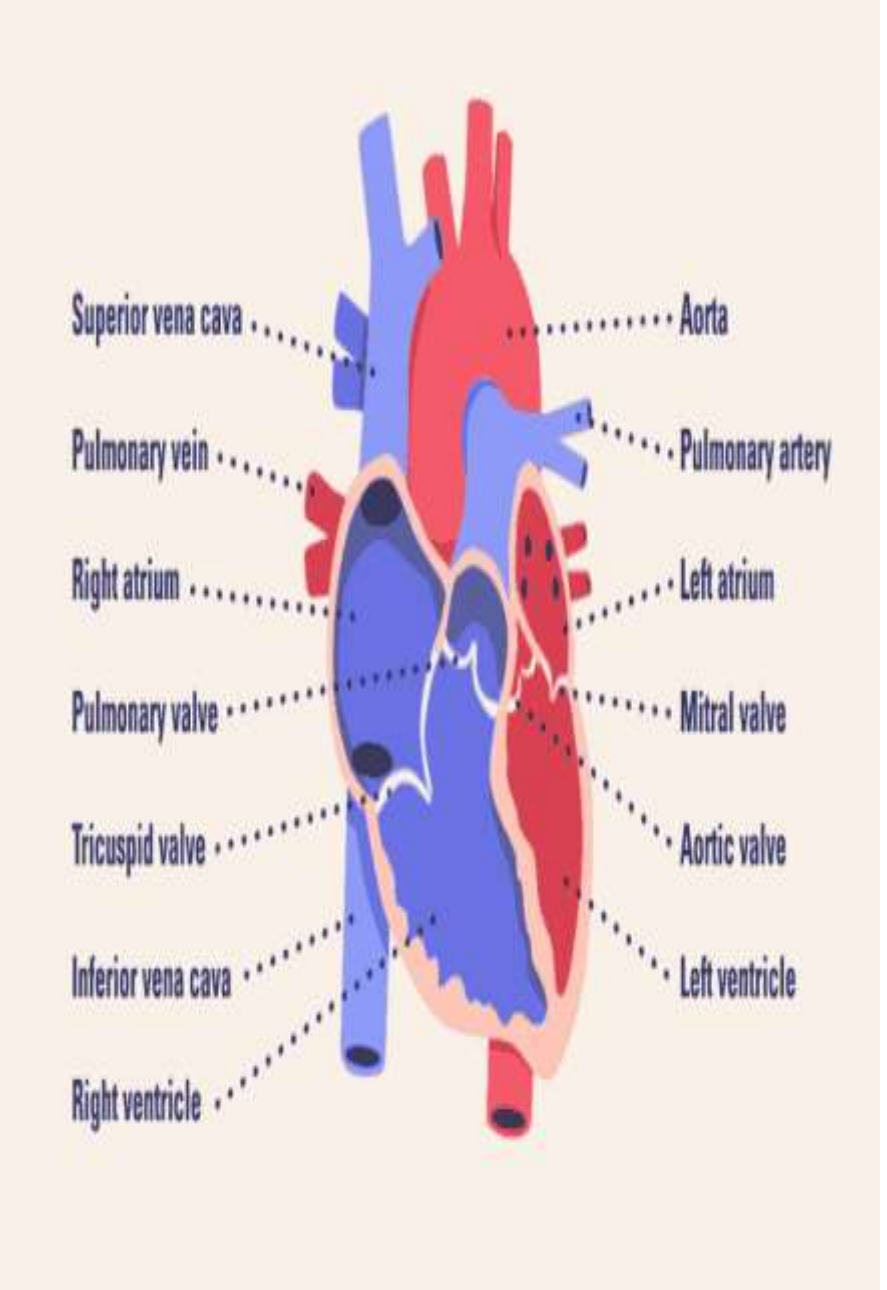
Cardiovascular System



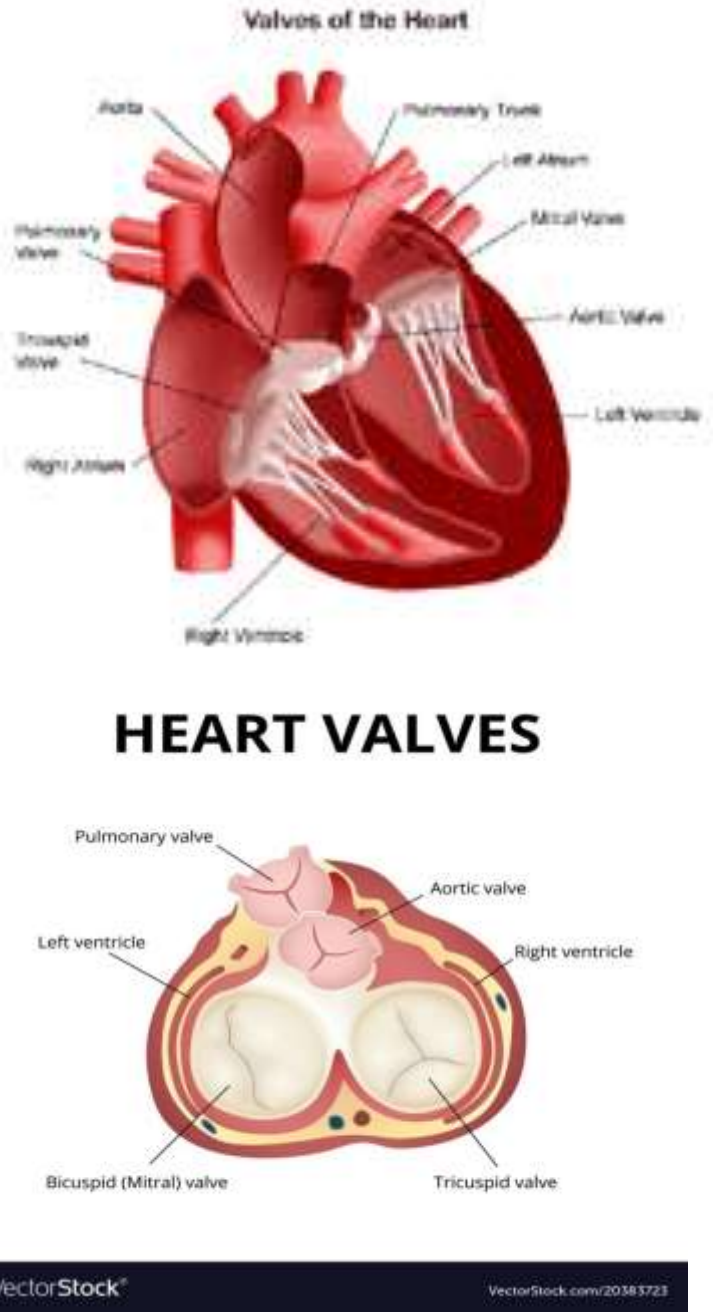
Physiology: Circulation

- The four chambers of the heart are the upper thin-walled atria that open into the thick-walled ventricles below.
- The pulmonary veins bring oxygenated blood from the lungs into the left atrium.
- The superior and inferior vena cava bring deoxygenated blood into the right atrium.
- The walls of the atria contract first and force blood into the two ventricles. Then the ventricles contract and send blood into the arteries.



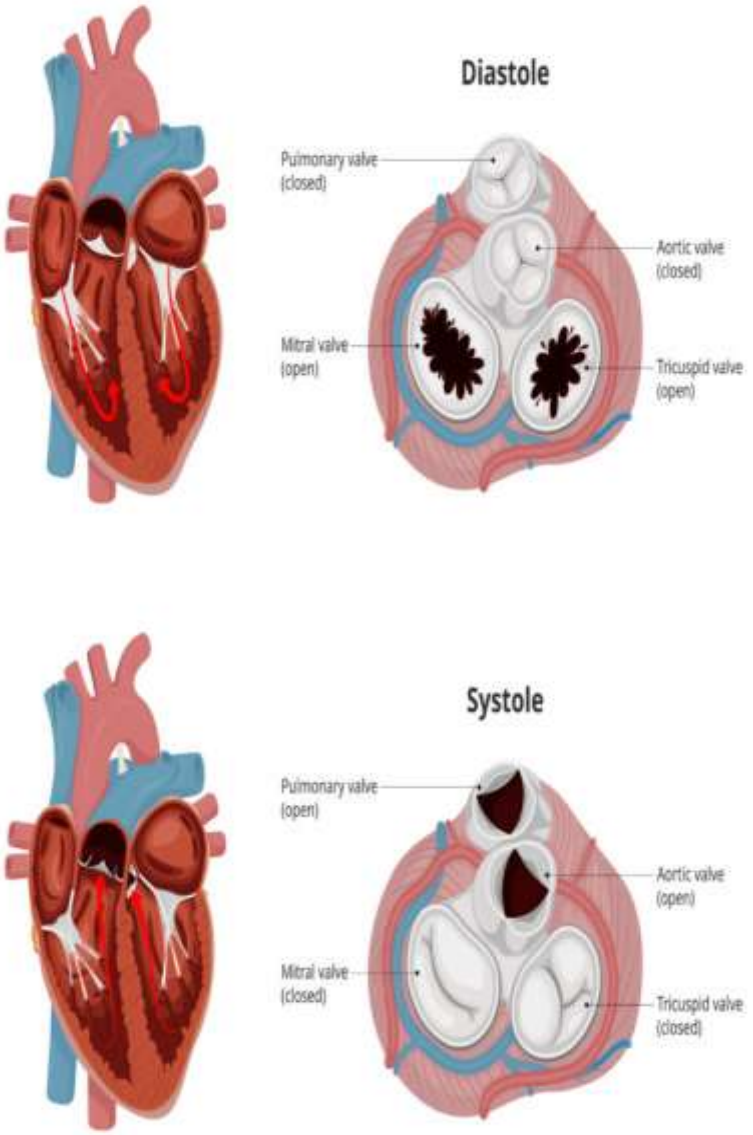
Physiology: Valves 1

- The blood is stopped from flowing backwards by two sets of valves.
- Between the right atrium and the right ventricle is the tricuspid valve.
- Between the left atrium and left ventricle is the bicuspid (mitral) valve.
- The flaps of these valves are shaped rather like parachutes, with strings called tendons or cords to prevent their being turned inside out.
- In the pulmonary artery and aorta are the semilunar (half-moon) valves.



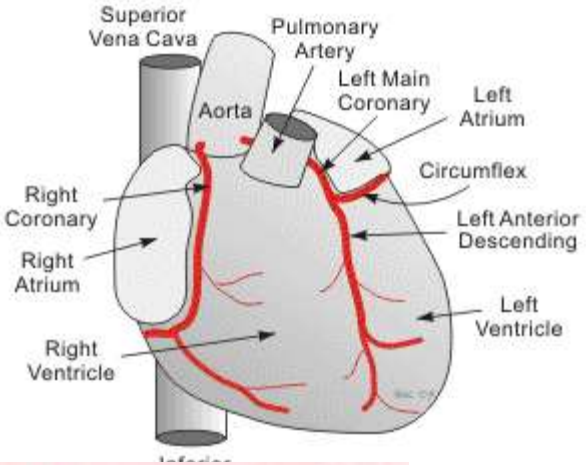
Physiology: mechanism

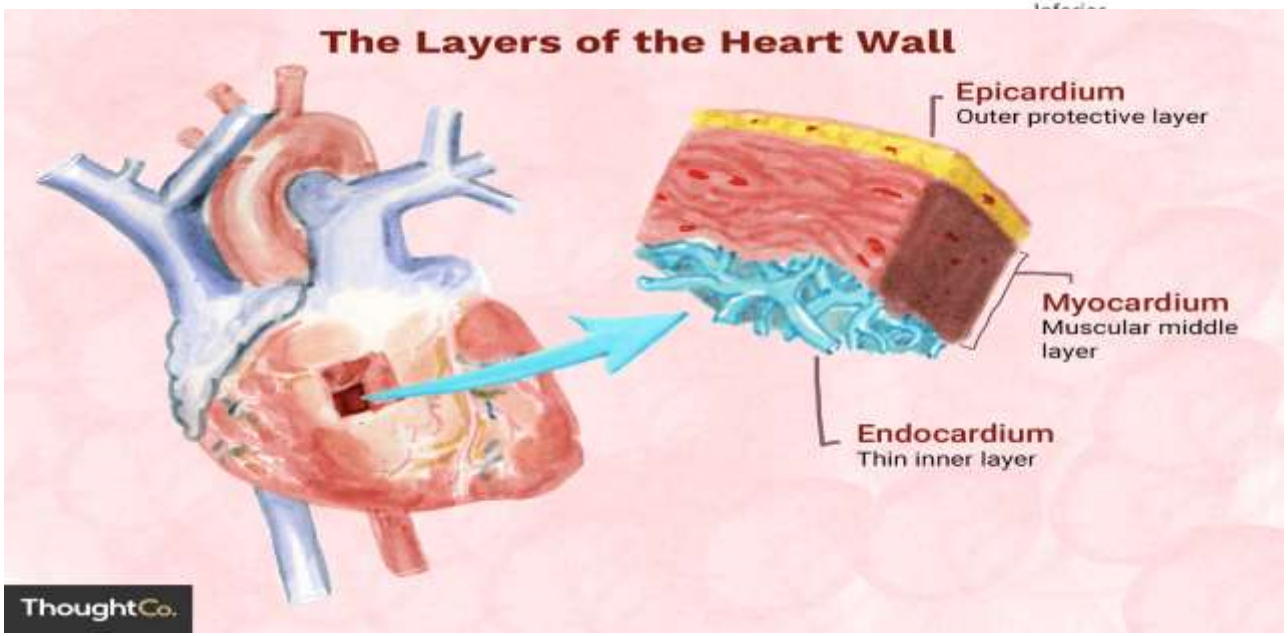
- When the ventricles contract, blood pressure closes the bicuspid and tricuspid valves and there prevent blood from returning to the atria.
- When the ventricles relax, the blood pressure in the arteries closes the semilunar valves, so preventing the return of blood to the ventricles.



Physiology: blood supply and histology

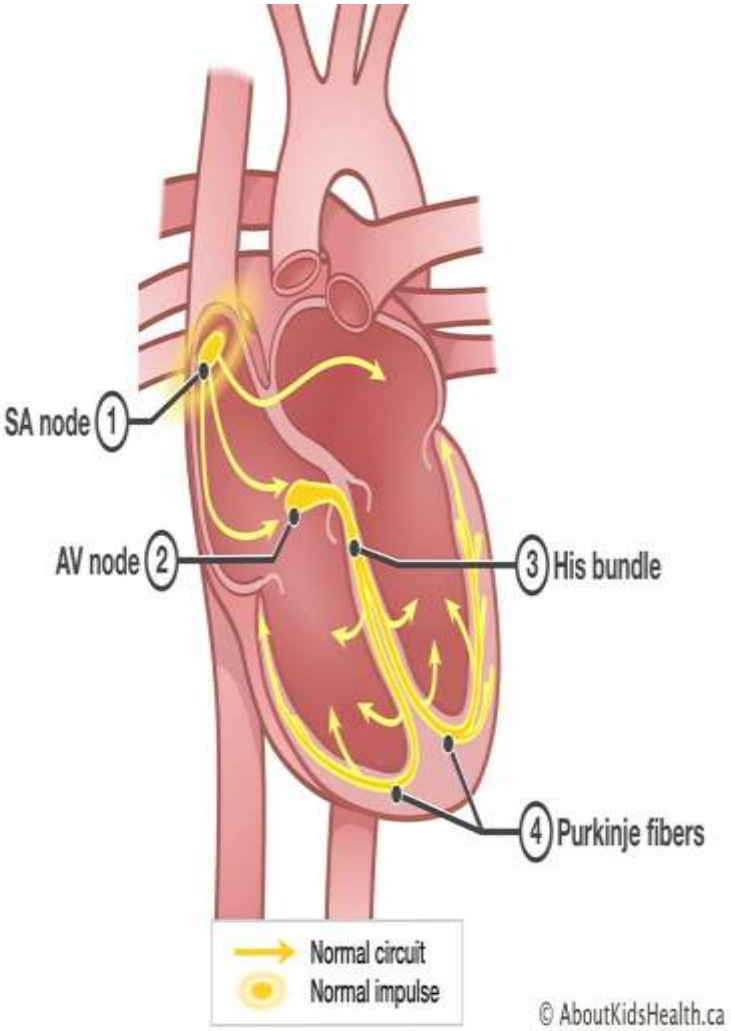
- The heart muscle is supplied with food and oxygen by the coronary arteries.
- The walls of the heart are composed of three layers: endocardium, myocardium and pericardium.





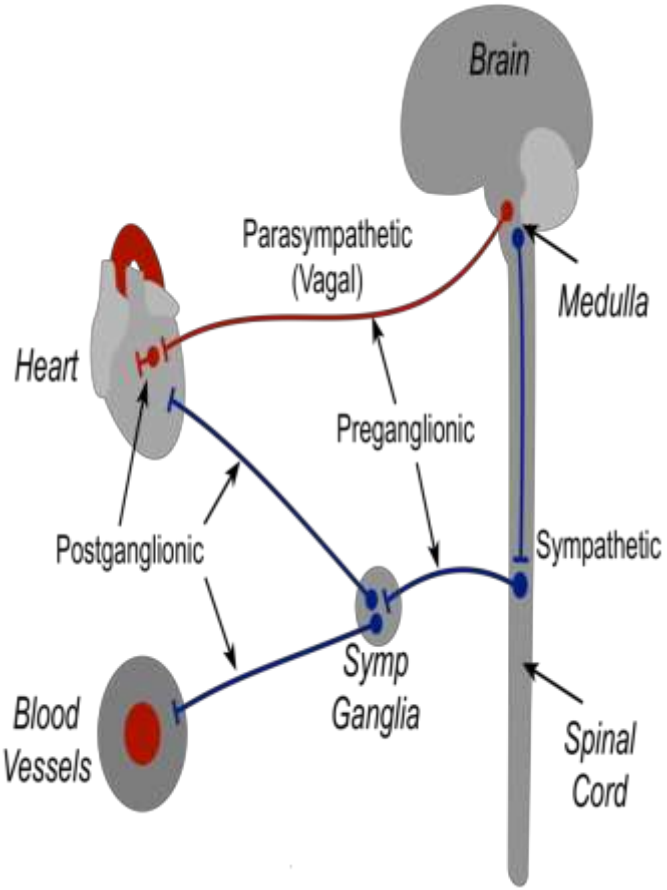
Physiology: Pulse conduction

- The heart beat is initiated by the pacemaker, a small group of specialized muscle cells at the top of the right atrium, called the sino-atrial node (S.A. node).
- Impulses pass from the S.A. node to the atrial walls, to the atrioventricular node (A.V. node), then to bundle of His, which divides into two main branches to the left and right ventricles.



Physiology: Nerve supply

- The S.A. node receives two sets of nerves from the brain; vagal nerve supply which slows the heart rate and sympathetic innervation that accelerates the heart.
- If blood pressure rises, nervous impulses reduce the heart rate. A fall in blood pressure causes a rise in the rate.
- Reduced oxygen concentration or increased carbon dioxide in the blood also cause a faster rate. By this means, the heart rate is adjusted to meet the needs of the body at times of rest, exertion and excitement.



A) Symptoms of heart failure (impaired cardiac functions)

Symptoms according to the impaired cardiac chamber

Left sided heart failure

Pulmonary congestion:

1- Dyspnea.
2- cough.
3- Orthopnea.
4- PND

Right sided heart failure

Systemic congestion

1- Lower limb oedema.
2- Ascites.
3- Liver congestion.
4- Maldigestion.

Dyspnea

- Awareness of breathing
- Normal on exercise
- May be caused cardiac, respiratory, metabolic conditions, anxiety
- Cardiac patients develop dyspnea because of fluid accumulation in the alveoli

Orthopnoea

- Dyspnea on lying flat relieved by sitting
- Lying flat increases venous return to the heart
- Can be graded by the number of pillows

Paroxysmal Nocturnal Dyspnea

- Sudden breathlessness which wakes the patient from sleep choking or gasping air
- Caused by gradual accumulation of alveolar fluid during sleep
- Patients may sit on the edge of the bed and open windows in an attempt to relieve their distress.
- Cough with frothy blood stained sputum
- Chest **Coarse crepitations**

LOWER LIMB EDEMA

- Caused by systemic venous congestion
- Dependent edema, lower limbs and sacral
- Bilateral pitting edema

Edema (swelling) of the ankles and feet

Differential diagnosis of bilateral LL edema

- Congestive heart failure
- Nephrotic syndrome
- Liver cirrhosis
- Renal failure

Differential diagnosis of unilateral leg swelling

- DVT
- Lymphatic obstruction
- Cellulitis

ABDOMINAL DISTENSION

- Ascites secondary to systemic venous congestion
- Occurs before edema in TR

B) Palpitation

Palpitation

- **Definition**: increased awareness of heart beats.
- The sensation is felt due to change of heart rate or due to irregular heart rhythm.
- Heart rate changes is either: rapid heart rate (tachycardia) or slow heart rate (bradycardia).
- Palpitation may be a normal finding during exercise, anxiety, or with excess consumption of coffee or nicotine.

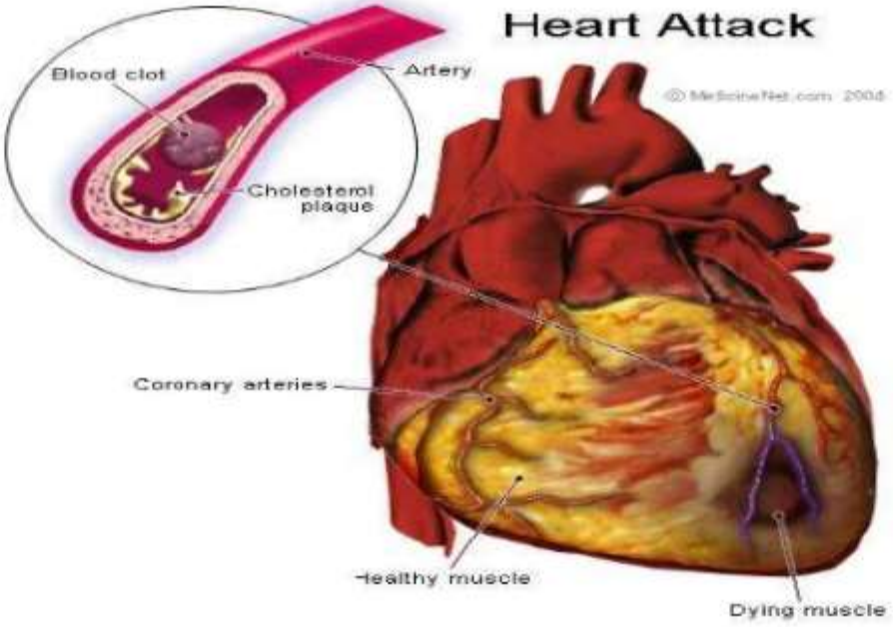
C) Chest pain

Angina pectoris

- Diffuse Dull discomfort felt in the centre of anterior chest
- Duration less than 10 minutes
- Tightness, pressure similar to carrying heavy weight
- May radiate to left arm, jaw and teeth
- Associated with sweating, palpitation
- Triggered by exercise, cold weather
- Relieved by rest, nitroglycerin sublingual

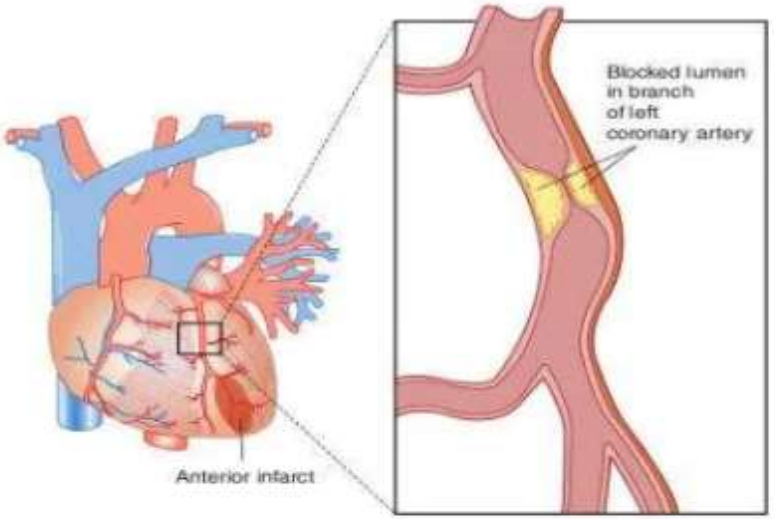
Unstable angina

- Angina of recent onset
- Increasing severity
- Angina at rest
- Is a medical emergency as it precede Myocardial infarction



Myocardial infarction

- Severe chest pain
- Prolonged duration
- Not relieved by rest or nitroglycerin
- Pallor, nausea, vomiting
- Pain may be absent in 30% particularly in the diabetics and old age



Other causes of chest pain (differential diagnosis) 1

1. **Pericarditis pain:**

- Sharp stitching anterior central chest pain.
- Increases by inspiration, movement and/or coughing.
- decreases by leaning forwards and holding breath.

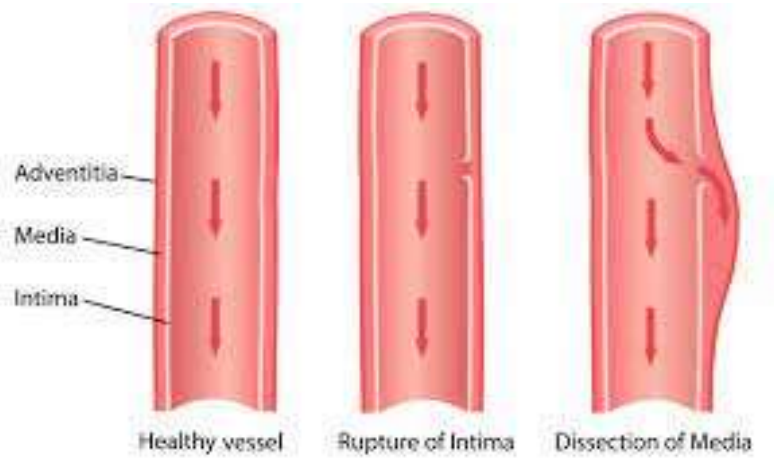
2. **Respiratory diseases:** As in

- Acute pleurisy.
- Pneumonia.
- Pneumothorax.
- Pulmonary embolism.

Other causes of chest pain (differential diagnosis) 2

3. **Dissecting aortic aneurysm:**

- Due to tear of the intima of the aorta.
- Abrupt severe intrascapular chest pain.
- Manifestations may differs according to the site: MI if ascending aorta (coronary artery origin) is involved, syncope and focal neurological defects if carotid artery is involved (arch of aorta).



4. **Esophageal diseases:** central anterior chest pain, similar to angina and may be difficult to differentiate (e.g. reflux esophagitis and motility disorders) or peptic ulcer pain.

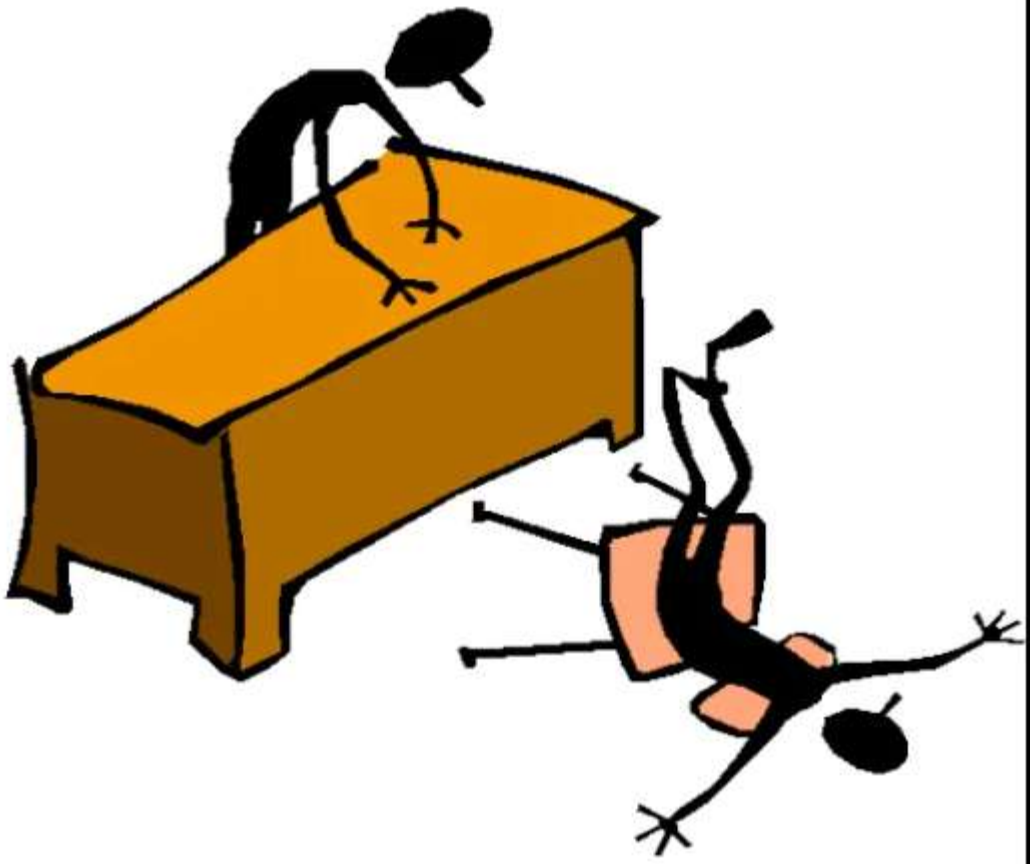
5. **Chest wall diseases:** Bone (fracture rib), muscle (myositis), nerve (herpes zoster).
6. **Referred pain:** Gall bladder disease.

D) Low cardiac output symptoms

Syncope

LOW CARDIAC OUTPUT

- Syncope is a faint with transient loss of consciousness
- Caused by decrease blood flow to the brain
- Caused by obstructive lesions (aortic stenosis), rhythm disturbance (heart block) or fast arrhythmia



Definition & Types

Definition

- Syncope is a sudden transient loss of consciousness & posture due to sudden decrease in blood flow to the brain
- Symptom, not a disease.
- Recovery is spontaneous and complete.
- Causes includes:

A. Obstructive lesions: as Aortic stenosis.
B. Brady arrhythmias: Heart block.
C. Fast arrhythmias.

Specific types

1. Vaso-vagal attack.
2. Postural hypotension.
3. Hypersensitive carotid sinus syndrome.
4. Cough (tussive) syncope.
5. Micturation syncope.
6. Arrhythmia " Adam's stoke attack“.

Vaso-vagal syncope

- Due to increase in parasympathetic (vagal) stimulation leading to bradycardia (decrease in heart rate) and vasodilatation leading to hypotension.
- Patient is pale, sweaty, with bradycardia and low blood pressure.
- The cause of increase vagal stimulation may be:

a- Sever pain

b- Fright

c- Witness of blood

d- Prolonged standing in crowded place

- Occurs in normal individuals.
- Preceded by nausea and sweating.

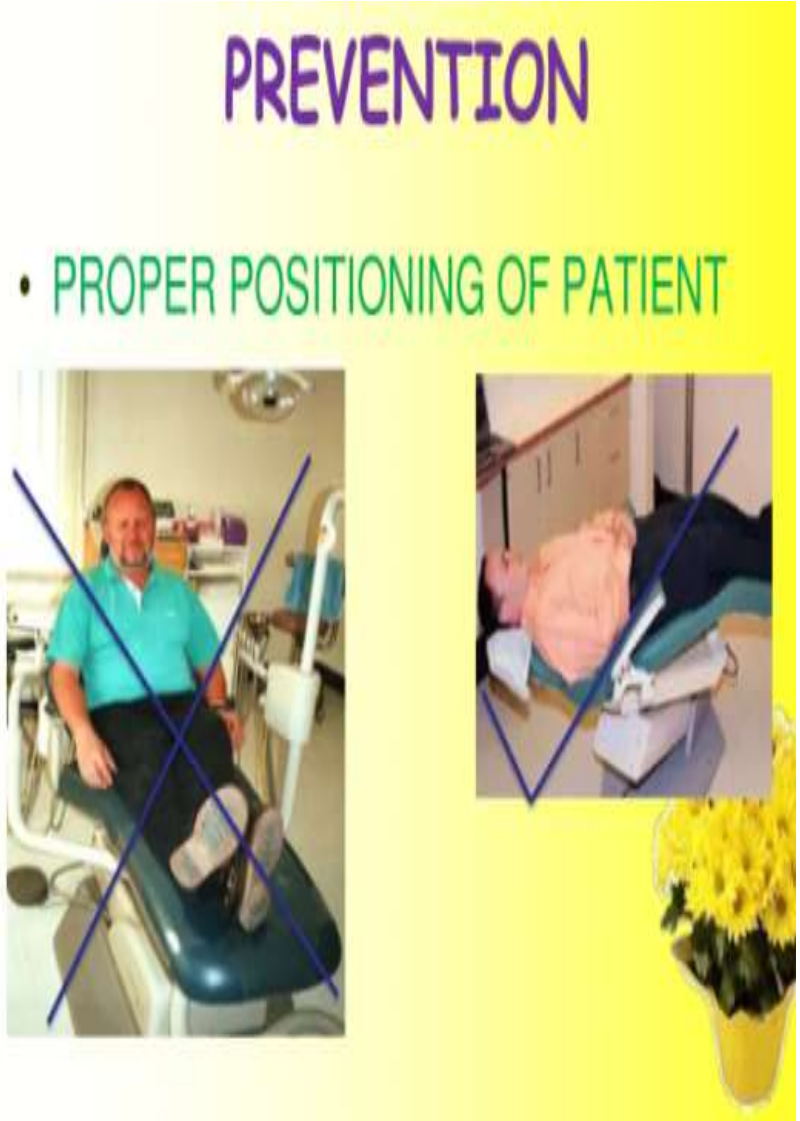
Postural hypotension

- Due to fall of systolic pressure more than 30 mmHg upon standing due to failure of compensatory mechanisms that helps venous return against gravity (vasoconstriction of lower limb vessels).
- Causes are:

a- Taking antihypertensive drugs that blocks sympathetic.

b- Prolonged illness with longstanding bed rest

c- Sympathetic degeneration as in diabetes and elderly.



Hypersensitive carotid sinus syndrome

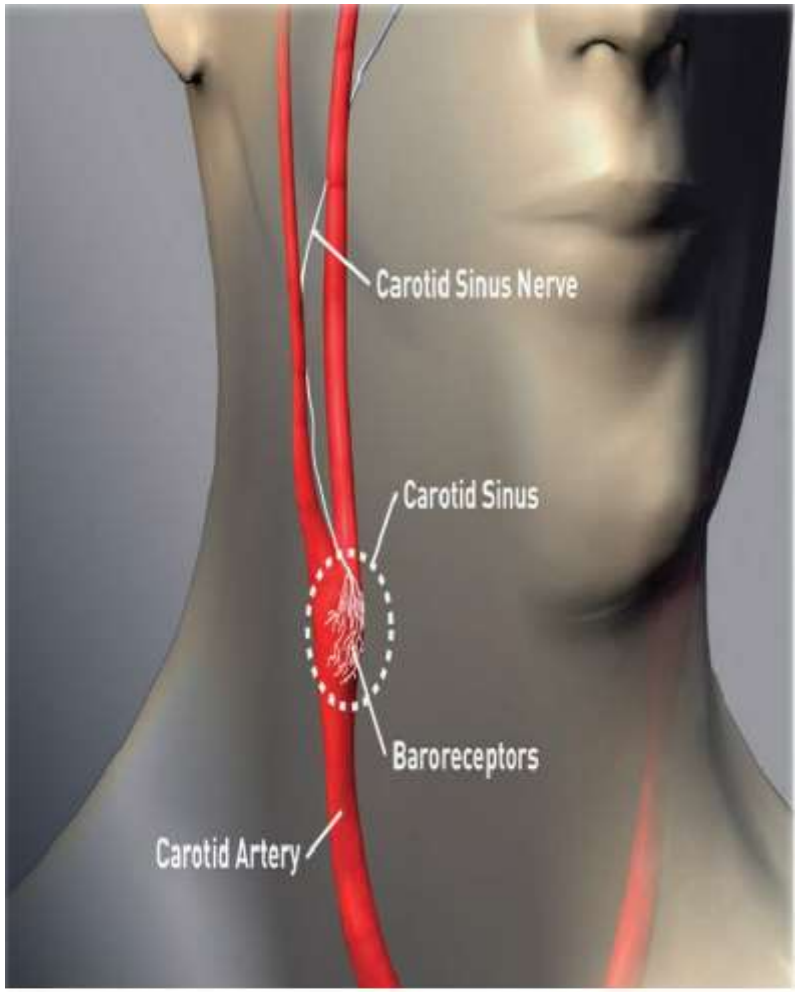
- Baroreceptors of the carotid sinus are hypersensitive to any slight outside pressure. When stimulated it sends impulses to the brain leading to increase in vagus tone leading to hypotension and syncope.

- Stimulation may results from:

a- Sudden turning of head

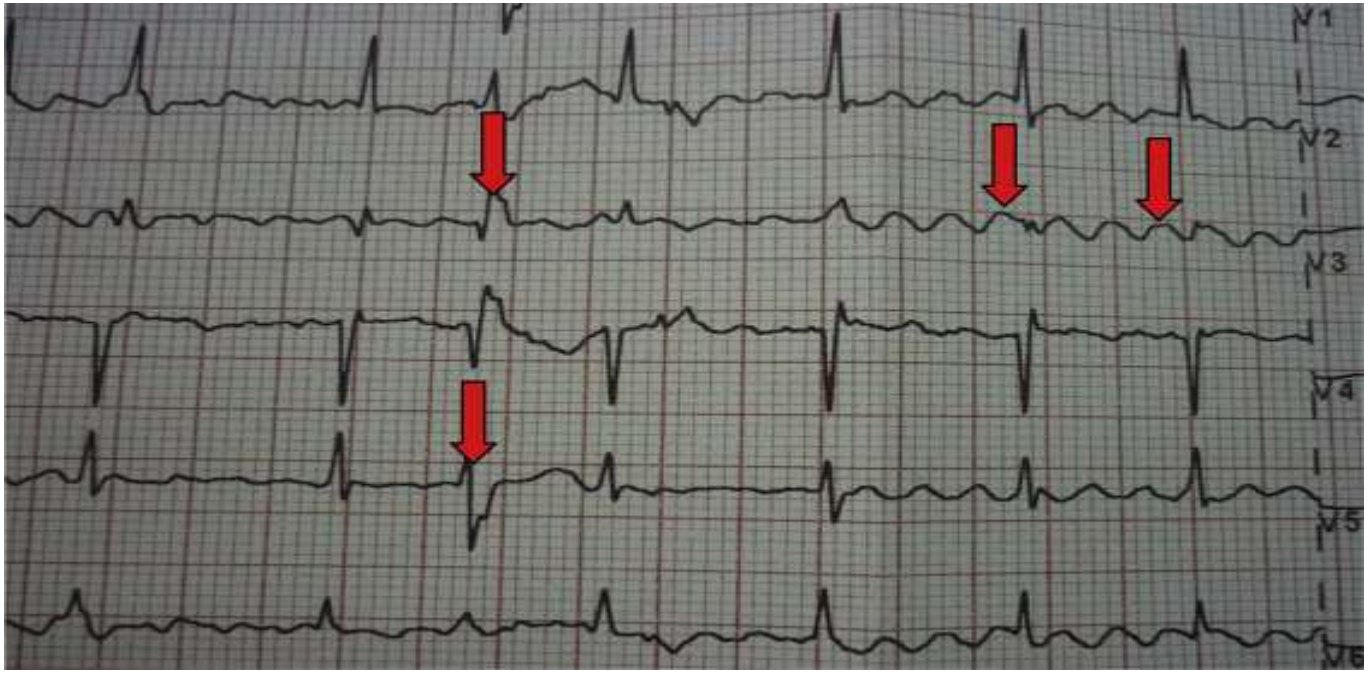
b- Wearing a tight collar

c- During shaving.



Arrhythmia " Adam's stoke attack"

- Due to complete heart block. The patient is pulseless and then heart rate is 40/ min.
- Mortality up to 50% if not treated.
- Pacemaker is the main line of management.



Cough (tussive) syncope

- Strain during severe cough attack may lead to increase in the intrapleural pressure (becomes positive instead of being negative) leading to decrease in venous return, decrease in cardiac output then hypotension and syncope.

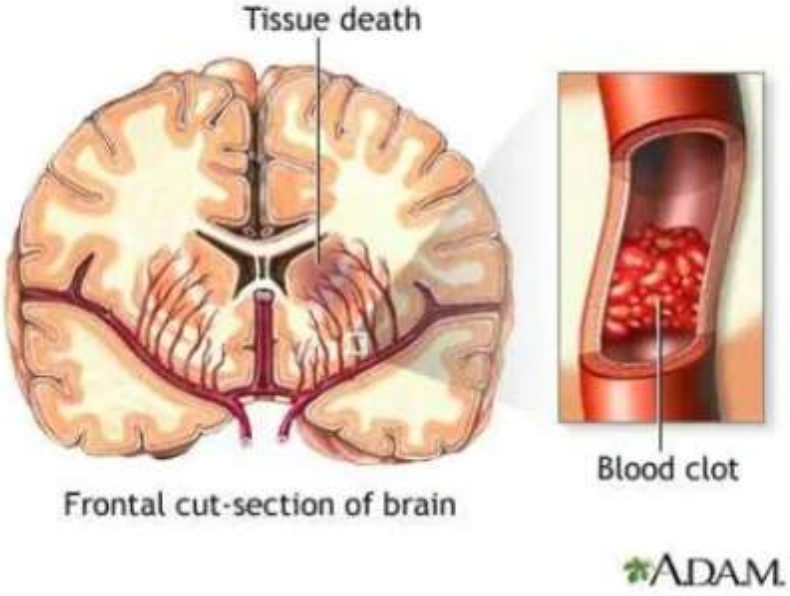
Micturition syncope

- Due to strain during micturition as in prostate enlargement leading to decrease venous return, decrease cardiac output, hypotension and syncope.

E) Embolic manifestations

EMBOLIC MANIFESTATIONS

- Stroke
- TIAs (aphasia, sensory, motor deficits lasting few hours)
- Atrial fibrillation causes left atrial thrombus with microemboli to cerebral circulation



Examination of cardiac patient

Cyanosis

- **Definition:** It is the bluish discoloration of skin and mucous membranes due to the presence of more than 5 grams reduced hemoglobin / 100ml blood.

1- **Central cyanosis:** the blood pumped to aorta contains more than 5 grams reduced hemoglobin / 100ml. it occurs in congenital heart diseases and also due to respiratory failure. In this case tongue and lips are cyanosis in addition to hands and feet. The arterial blood contains increased reduced hemoglobin (less oxygen). The hands are warm.

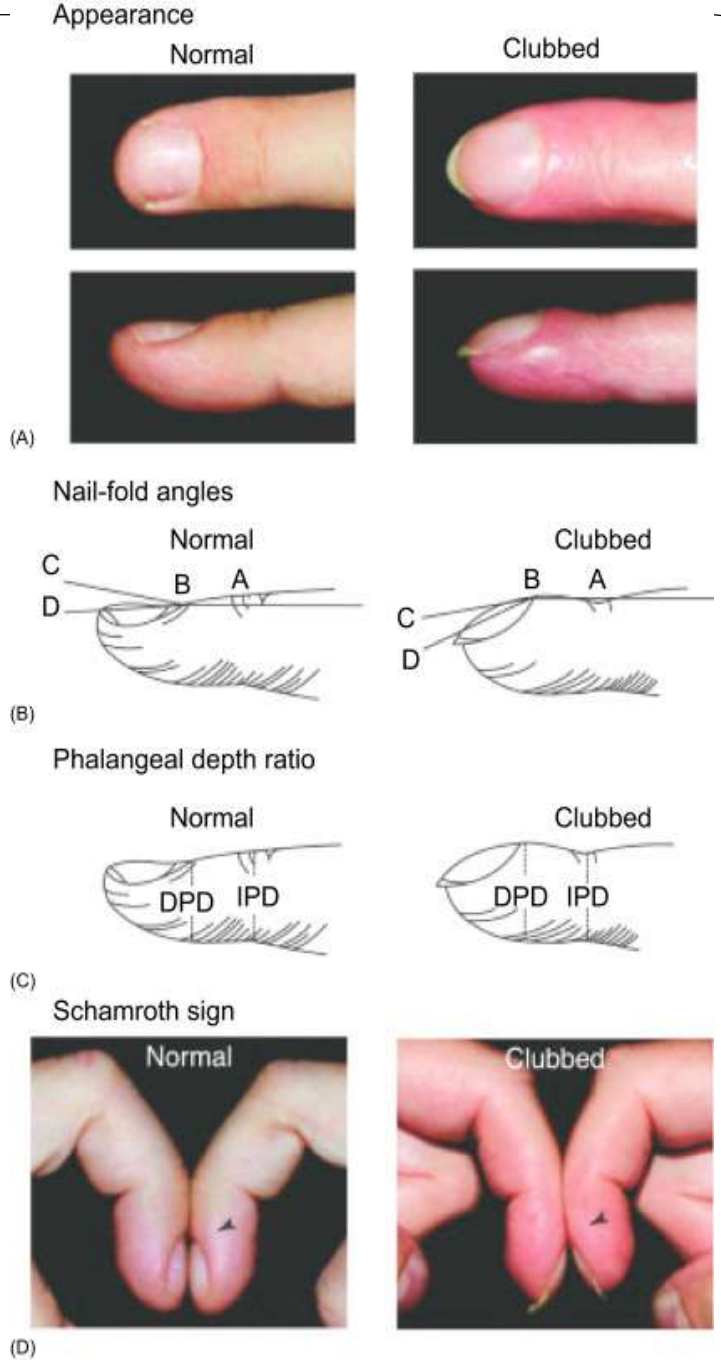
2- **Peripheral cyanosis:** it is due to deceased blood flow to hand and feet. It may occur in case of left sided heart failure or during exposure to cold. It is due to slow blood flow and excessive extraction of oxygen. The hands are cold.

clubbing

- It is the obliteration of the angle at nail bed due to proliferation of the soft tissue in response to either hypoxia or toxemia.

Clubbing may be:

- 1- Blue clubbing in congenital cyanotic heart diseases and respiratory failure (same causes of cyanosis).
- 2- Pale clubbing associated with toxemia as in infective endocarditis.



Examination of the neck veins

- Observation of the column of blood in the internal jugular vein is a good measure of right atrial pressure.
- Increased venous pressure inside internal jugular vein occurs in patients with:

1. Heart failure (Right side).
2. Pericardial effusion.
3. Superior vena cava obstruction.

THANK YOU